



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2018; 6(5): 3179-3184

© 2018 IJCS

Received: 25-07-2018

Accepted: 30-08-2018

**AC Parab**

Department of Agril.  
Entomology, College of  
Agriculture, Dapoli  
Dr. Balasaheb Konkan Krishi  
Vidyapeeth, Dapoli, Ratnagiri,  
Maharashtra, India

**SD Desai**

Department of Agril.  
Entomology, College of  
Agriculture, Dapoli  
Dr. Balasaheb Konkan Krishi  
Vidyapeeth, Dapoli, Ratnagiri  
Maharashtra, India

**SK Mehendale**

Department of Agril.  
Entomology, College of  
Agriculture, Dapoli  
Dr. Balasaheb Konkan Krishi  
Vidyapeeth, Dapoli, Ratnagiri,  
Maharashtra, India

**VS Desai**

Department of Agril.  
Entomology, College of  
Agriculture, Dapoli  
Dr. Balasaheb Konkan Krishi  
Vidyapeeth, Dapoli, Ratnagiri,  
Maharashtra, India

**GM Golvankar**

Department of Agril.  
Entomology, College of  
Agriculture, Dapoli  
Dr. Balasaheb Konkan Krishi  
Vidyapeeth, Dapoli, Ratnagiri,  
Maharashtra, India

**Correspondence****AC Parab**

Department of Agril.  
Entomology, College of  
Agriculture, Dapoli  
Dr. Balasaheb Konkan Krishi  
Vidyapeeth, Dapoli, Ratnagiri,  
Maharashtra, India

## Effect of attractants for trapping fruit flies infesting mango

AC Parab, SD Desai, SK Mehendale, VS Desai and GM Golvankar

**Abstract**

The present investigation was carried out on the effect of attractants for trapping of fruit flies infesting mango at Horticulture Nursery, Department of Horticulture, College of Agriculture, Dapoli during May to July 2017. Results revealed that the total number of fruit flies caught per trap during May 2017 in treatment T<sub>2</sub> (Black *Ocimum* + Malathion) was found to be the best treatments by trapping maximum (140.00) number of fruit flies per trap and was found to be significantly superior over the rest of the treatments except the treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) which recorded 125.33 number of fruit flies and was at par with T<sub>2</sub>. In June 2017 total number of fruit flies trapped per trap maximum (190.00) in treatment T<sub>2</sub> (Black *Ocimum* + Malathion) and the treatment was found to be significantly superior over the rest of the treatments except the treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) which recorded 173.00 number of fruit flies per trap but it was at par with treatment T<sub>2</sub>. While the total number of fruit flies trapped per trap during July 2017 maximum (33.67) in the treatment T<sub>2</sub> (Black *Ocimum* + Malathion) and was found to be significantly superior over the rest of the treatments except treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) which recorded 27.00 number of fruit flies per trap and both the treatments were at par with each other.

**Keywords:** attractant, baits, *Ocimum* sp., Fruit flies etc.

**Introduction**

Mango (*Mangifera indica* L.) is the oldest and choicest fruit of the world. It is considered as 'National fruit of India' and known as 'King of fruits' owing to its nutritional richness, unique taste, pleasant aroma and its religious and medicinal importance. Due to its good qualities and high medicinal values, it is enjoyed by masses and classes from all corners of the world.

The total world production of mango is 43,300,000 tonnes (Anon., 2015b) [3]. It is commercially grown in more than 111 countries but nowhere it is as greatly valued as in India where 40 per cent of area under fruit crops is only under mango. India is the major mango producer in the world, with an area of 2.218 million hectares and the annual production of 18.832 million tonnes with productivity of 8.49 MT/ha. (Anon., 2015a) [2]. India contributes about 64 per cent of the world mango production. In Maharashtra, mango occupying an area of 4.82 lakh ha with annual production of 6.33MT with productivity of 1.3MT/ha (Anon., 2014) [1].

In Konkan, 1, 82,000 ha area is under mango cultivation with annual production of 3.25 lakh MT. The productivity of mango in Konkan is about 2.5 t/ha, which is about three times less than the average productivity of the country (Anon., 2014) [1]. In Konkan, about 90 per cent area of mango is occupied by single cultivar "Alphonso", which is locally called as "Hapus".

In spite of all good points, the mango crop suffers a regular colossal loss due to ravages of pest. Among the insect-pests, fruit fly is the serious and destructive pest of mango. Methyl eugenol is commonly used for trapping mango fruit flies. However, commercial synthesizing process of methyl eugenol is expensive and importation of required chemicals for the methylation process is difficult due to its high toxic nature. Therefore, development of an effective, plant based insect attractant, at an affordable price and easily available to the farmers is urgently needed. Most of the fruit flies are having limited distribution perhaps due to physical, climatic and vegetative factors and host specificity. Adult flies feed in the neighbourhoods and when they come to the target tree they are ready to lay their eggs. Under these conditions the poisoned baits are helpless. People in general are not equipped to apply pesticides and it would not be recommended in backyards within inhabited areas. One control option is fruit bagging, but it would be unfeasible in tall trees and expensive also.

Though the crop is economically important, the information on the fruit flies attractant is very much lacking particularly in Konkan region in Maharashtra. Hence, the present investigations were undertaken for the study effect of attractants for trapping fruit flies infesting mango.

## Materials and Methods

### Experimental detail

1. Crop	:	Mango
2. Variety	:	Alphonso
3. Statistical Design	:	Randomized Block Design
4. No. of replications	:	3
5. No. of Treatments	:	13
6. Period of study	:	May to July 2017
7. Treatment details	:	

T <sub>1</sub>	:	Green <i>Ocimum</i> (leaf extract) (3ml) + Malathion (2ml)
T <sub>2</sub>	:	Black <i>Ocimum</i> (leaf extract) (3ml) + Malathion (2ml)
T <sub>3</sub>	:	Black Jaggery solution (3ml) + Malathion (2ml)
T <sub>4</sub>	:	Common Jaggery solution (3ml) + Malathion (2ml)
T <sub>5</sub>	:	Cinnamon (leaf extract) (3ml) + Malathion (2ml)
T <sub>6</sub>	:	Molasses (3ml) + Malathion (2ml)
T <sub>7</sub>	:	Green <i>Ocimum</i> (leaf extract) (3ml) + Spinosad (2ml)
T <sub>8</sub>	:	Black <i>Ocimum</i> (leaf extract) (3ml) + Spinosad (2ml)
T <sub>9</sub>	:	Black Jaggery solution (3ml) + Spinosad (2ml)
T <sub>10</sub>	:	Common Jaggery solution (3ml) + Spinosad (2ml)
T <sub>11</sub>	:	Cinnamon (leaf extract) (3ml) + Spinosad (2ml)
T <sub>12</sub>	:	Molasses (3ml) + Spinosad (2ml)
T <sub>13</sub>	:	Control (Without Attractant)

### Procedure for preparation of extracts of attractant

The mature leaves of green *Ocimum*, black *Ocimum* and Cinnamon were properly washed with water and after proper cleaning grinded with the help of pestle and mortar for about 3 to 4 minute separately. The grinded material was passed through muslin cloth sieve to obtain the clear extracts which were used as an attractant material. In case of black Jaggery and common Jaggery, the solutions were prepared by adding 100 g of each in 200 ml distilled water separately and then used as an attractant material. Other attractants such as molasses, Malathion and Spinosad were used as such.

### Experimental layout

A block of uniform sized Mango trees (13 trees per replication) of Alphonso variety were randomly selected for the field experiment. Each trap was charged with attractant material as per the treatment details at 15 days interval. The traps containing various attractant materials were placed hanging randomly on the mango trees.

### Method of recording observation

The fruit flies trapped in each treatment were collected at five days interval. The data on number of fruit flies per trap was subjected to  $\sqrt{n+1}$  transformation and analysed statistically.

## Results and Discussion

### Fruit fly population trapped with different baiting material during May 2017

The observations on the effect of attractant in capturing fruit flies during May-2017 (17/05/2017 to 27/05/2017) are presented in Table 1.

The observations recorded on the mean number of fruit flies trapped per trap on 17/05/2017 was in the range of 0.00 to 45.33. It was revealed that the maximum (45.33) number of fruit flies were trapped in the treatment T<sub>2</sub> (Black *Ocimum* +

Malathion) which was significantly superior over the rest of the treatments except treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) which recorded 42.67 mean number of fruit flies and it was at par with treatment T<sub>2</sub>. The next best treatments in order of efficacy were T<sub>1</sub> (Green *Ocimum* + Malathion), T<sub>7</sub> (Green *Ocimum* + Spinosad) and T<sub>9</sub> (Black Jaggery + Spinosad) which recorded 36.33, 33.00, and 32.67 mean number of fruit flies respectively and were superior over the rest of the treatments.

The observations recorded on the mean number of fruit flies trapped on 22/05/2017 was in the range of 0.00 to 47.67. The data revealed that the maximum (47.67) number of fruit flies were trapped in the treatment T<sub>2</sub> (Black *Ocimum* + Malathion) which was significantly superior over the rest of the treatments except treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) which recorded 41.67 mean number of fruit flies and both the treatments were at par with each other. The next best treatments in order of efficacy were T<sub>1</sub> (Green *Ocimum* + Malathion), T<sub>3</sub> (Black Jaggery + Malathion), T<sub>6</sub> (Molasses +Malathion), T<sub>5</sub> (Cinnamon + Malathion), T<sub>7</sub> (Green *Ocimum* + Spinosad) and T<sub>9</sub> (Black Jaggery + Spinosad) which recorded 33.33, 31.00, 31.00, 28.00, 27.67 and 23.67 mean number of fruit flies respectively. The minimum fruit flies (14.67) were recorded in the treatment T<sub>10</sub> (common jaggery + spinosad).

The observations on the mean number of fruit flies trapped per trap on 27/05/2017 was in the range of 0.00 to 47.00. The results revealed that the maximum number of fruit flies were trapped in treatment T<sub>2</sub> (Black *Ocimum* + Malathion) followed by treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) and both the treatments were significantly superior over the rest of the treatments by catching 47.00 and 41.00 fruit flies per trap. The next best treatments in order of efficacy were T<sub>1</sub> (Green *Ocimum* + Malathion), T<sub>3</sub> (Black Jaggery + Malathion), T<sub>6</sub> (Molasses +Malathion), T<sub>5</sub> (Cinnamon + Malathion) and T<sub>7</sub> (Green *Ocimum* + Spinosad) which recorded 32.67, 30.67, 29.67, 27.33 and 27.00 mean number of fruit flies respectively and these treatments were significantly superior over the rest of the treatments except T<sub>2</sub> and T<sub>8</sub>.

The data on the total number of fruit flies trapped per trap data revealed that the total number of fruit flies caught per trap during May 2017 was in the range of 0.00 to 140.00. The treatment T<sub>2</sub> (Black *Ocimum* + Malathion) was found to be the best treatments by trapping maximum (140.00) number of fruit flies per trap and was found to be significantly superior over the rest of the treatments except the treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) which recorded 125.33 number of fruit flies and was at par with T<sub>2</sub>. The next best treatments in order of efficacy were T<sub>1</sub> (Green *Ocimum* + Malathion), T<sub>3</sub> (Black Jaggery + Malathion), T<sub>7</sub> (Green *Ocimum* + Spinosad) and T<sub>6</sub> (Molasses +Malathion) which recorded 102.33, 88.67, 87.67 and 85.67 fruit flies per trap respectively.

### Fruit fly population trapped with different baiting material during June 2017

The observations on the effect of attractant in trapping fruit flies during June 2017 (1/06/2017 to 26/06/2017) are presented in Table 2.

The observations on the mean number of fruit flies trapped per trap on 1/06/2017 was in the range of 0.00 to 45.67. The data revealed that the maximum (45.67) number of fruit flies were trapped in treatment T<sub>2</sub> (Black *Ocimum* + Malathion) which was the significantly superior over the rest of the treatments except treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) which recorded 39.33 mean number of fruit flies and the

treatment was at par with T<sub>2</sub>. The next best treatments in order of efficacy were T<sub>1</sub> (Green *Ocimum* + Malathion), T<sub>3</sub> (Black Jaggery + Malathion), T<sub>6</sub> (Molasses +Malathion), T<sub>5</sub> (Cinnamon + Malathion), T<sub>7</sub> (Green *Ocimum* + Spinosad), T<sub>9</sub> (Black Jaggery + Spinosad) and T<sub>12</sub> (Molasses + Spinosad) which recorded 30.67, 29.33, 27.67, 26.00, 25.33, 22.00 and 21.00 mean number of fruit flies respectively and all these treatments were significantly superior over rest of the treatments except T<sub>2</sub> and T<sub>8</sub>.

The observations on the mean number of fruit flies trapped per trap on 6/06/2017 was in the range of 0.00 to 40.33. The data revealed that the maximum (40.33) number of fruit flies were trapped in treatment T<sub>2</sub> (Black *Ocimum* + Malathion) which was significantly superior over the rest of the treatments except treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) which recorded 39.00 mean number of fruit flies and both the treatments were at par with each other. The next best treatments in order of efficacy were T<sub>1</sub> (Green *Ocimum* + Malathion), T<sub>7</sub> (Green *Ocimum* + Spinosad), T<sub>3</sub> (Black Jaggery + Malathion), T<sub>6</sub> (Molasses +Malathion) and T<sub>5</sub> (Cinnamon + Malathion) which recorded 28.00, 24.33, 23.00, 22.67 and 22.00 mean number of fruit flies respectively. The minimum number of fruit flies were trapped in treatment T<sub>10</sub> (common Jaggery + Spinosad) which were 11.33 fruit flies per trap.

The observations on the mean number of fruit flies trapped per trap on 11/06/2017 was in the range of 0.00 to 23.67. The data revealed that the maximum (23.67) number of fruit flies were trapped in treatment T<sub>2</sub> (Black *Ocimum* + Malathion) which was the significantly superior over the rest of the treatments except treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) and treatment T<sub>7</sub> (Green *Ocimum* + Spinosad) which recorded 22.33 and 17.00 mean number of fruit flies respectively, and all the three treatments were at par with each other. The next best treatments in order of efficacy were T<sub>1</sub> (Green *Ocimum* + Malathion), T<sub>3</sub> (Black Jaggery + Malathion), and T<sub>6</sub> (Molasses +Malathion) which recorded 18.67, 13.33, and 13.33 mean number of fruit flies respectively.

The observations recorded on the mean number of fruit flies per trap on 16/06/2017 was in the range of 0.00 to 35.00. The data revealed that the maximum (35.00) number of fruit flies were trapped in the treatment T<sub>2</sub> (Black *Ocimum* + Malathion) and was significantly superior over the rest of the treatments except treatment T<sub>8</sub> (Black *Ocimum* + Spinosad), T<sub>1</sub> (Green *Ocimum* + Malathion), and treatment T<sub>7</sub> (Green *Ocimum* + Spinosad) which recorded 33.67, 26.00 and 25.33 mean number of fruit flies respectively, and all these treatments were at par with T<sub>2</sub>. The next best treatments in order of efficacy were T<sub>3</sub> (Black Jaggery + Malathion), T<sub>5</sub> (Cinnamon + Malathion), T<sub>6</sub> (Molasses +Malathion), T<sub>9</sub> (Black Jaggery + Spinosad), T<sub>12</sub> (Molasses + Spinosad) and T<sub>11</sub> (Cinnamon + Spinosad) which recorded 17.00, 15.33, 15.33, 15.33, 15.33 and 14.67 mean number of fruit flies respectively.

The observations recorded on the mean number of fruit flies trapped per trap on 21/06/2017 was in the range of 0.00 to 28.33. The results revealed that the maximum (28.33) number of fruit flies were trapped in treatment T<sub>2</sub> (Black *Ocimum* + Malathion) which was significantly superior over the rest of the treatments except treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) which recorded 26.67 mean number of fruit flies but it was at par with the treatment T<sub>2</sub>. The next best treatments in order of efficacy were T<sub>1</sub> (Green *Ocimum* + Malathion) and T<sub>7</sub> (Green *Ocimum* + Spinosad) which recorded 19.33 and 17.00 mean number of fruit flies respectively. The minimum numbers of fruit flies were

trapped in the treatment T<sub>10</sub> (common Jaggery + Spinosad) which recorded 5.00 fruit flies per trap.

The observations on the mean number of fruit flies trapped per trap on 26/06/2017 was in the range of 0.00 to 17.00. The data revealed that the maximum (17.00) number of fruit flies were trapped in the treatment T<sub>2</sub> (Black *Ocimum* + Malathion) which was significantly superior over the rest of the treatments except treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) and treatment T<sub>1</sub> (Green *Ocimum* + Malathion) which recorded 12.00 and 11.00 mean number of fruit flies respectively, and both the treatments were at par with treatment T<sub>2</sub>. The next best treatments in order of efficacy were T<sub>3</sub> (Black Jaggery + Malathion), T<sub>7</sub> (Green *Ocimum* + Spinosad), T<sub>6</sub> (Molasses +Malathion) and T<sub>9</sub> (Black Jaggery + Spinosad) which recorded 10.33, 9.00, 6.67 and 6.67 mean number of fruit flies respectively.

The data on the total number of fruit flies trapped per trap during June was in the range of 0.00 to 190.00. The maximum (190.00) number of fruit flies were trapped in treatment T<sub>2</sub> (Black *Ocimum* + Malathion) and the treatment was found to be significantly superior over the rest of the treatments except the treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) which recorded 173.00 number of fruit flies per trap but it was at par with treatment T<sub>2</sub>. The next best treatments in order of efficacy were T<sub>1</sub> (Green *Ocimum* + Malathion) and T<sub>7</sub> (Green *Ocimum* + Spinosad) which recorded 133.67 and 118.00 number of fruit flies respectively. The minimum numbers of fruit flies were recorded in the treatment T<sub>10</sub> (common Jaggery + Spinosad) which were 43.00 fruit flies per trap.

#### **Fruit fly population trapped with different baiting material during July 2017**

The observation on the effect of attractant in trapping fruit flies during July 2017 (1/07/2017 to 21/07/2017) are presented in Table 3.

The observations on the mean number of fruit flies trapped per trap on 1/07/2017 was in the range of 0.00 to 13.67. The data revealed that the maximum (13.67) number of fruit flies were trapped in treatment T<sub>2</sub> (Black *Ocimum* + Malathion) which was significantly superior over the rest of the treatments except treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) which recorded 9.33 mean number of fruit flies per trap and both the treatments were at par with each other. The next best treatments in order of efficacy were T<sub>1</sub> (Green *Ocimum* + Malathion), T<sub>3</sub> (Black Jaggery + Malathion), T<sub>7</sub> (Green *Ocimum* + Spinosad) and T<sub>9</sub> (Black Jaggery + Spinosad) which recorded 8.33, 7.00, 6.33 and 5.67 mean number of fruit flies respectively.

The observations on the mean number of fruit flies trapped per trap on 6/07/2017 was in the range of 0.00 to 5.33. The data revealed that the maximum (5.33) number of fruit flies were trapped in the treatment T<sub>2</sub> (Black *Ocimum* + Malathion) and found to be significantly superior over the rest of the treatments except treatment T<sub>8</sub> (Black *Ocimum* + Spinosad), T<sub>1</sub> (Green *Ocimum* + Malathion) and treatment T<sub>7</sub> (Green *Ocimum* + Spinosad) which recorded 5.00, 3.33 and 3.00 mean number of fruit flies respectively, and all these treatments were at par with T<sub>2</sub>. The next best treatments in order of efficacy were T<sub>3</sub> (Black Jaggery + Malathion), T<sub>5</sub> (Cinnamon + Malathion), T<sub>6</sub> (Molasses +Malathion), T<sub>9</sub> (Black Jaggery + Spinosad), T<sub>11</sub> (Cinnamon + Spinosad) and T<sub>12</sub> (Molasses + Spinosad) which recorded 2.33, 2.33, 2.33, 2.33, 2.00 and 2.00 mean number of fruit flies respectively.

The observations on the mean number of fruit flies trapped per trap on 11/07/2017 was in the range of 0.00 to 6.00. The

data revealed that the maximum (6.00) number of fruit flies were trapped in the treatment T<sub>2</sub> (Black *Ocimum* + Malathion) which was significantly superior over the rest of the treatments except treatment T<sub>8</sub> (Black *Ocimum* + Spinosad), T<sub>1</sub> (Green *Ocimum* + Malathion) and treatment T<sub>7</sub> (Green *Ocimum* + Spinosad) which recorded 5.67, 4.67 and 3.67 mean number of fruit flies respectively, that the treatments were at par with T<sub>2</sub>. The next best treatments in order of efficacy were T<sub>3</sub> (Black Jaggery + Malathion), T<sub>9</sub> (Black Jaggery + Spinosad), T<sub>6</sub> (Molasses + Malathion), T<sub>12</sub> (Molasses + Spinosad), T<sub>5</sub> (Cinnamon + Malathion), T<sub>11</sub> (Cinnamon + Spinosad) and T<sub>4</sub> (Common Jaggery + Malathion) which recorded 2.33, 2.00, 1.67, 1.67, 1.33, 1.00 and 0.67 mean number of fruit flies respectively.

The observations on the mean number of fruit flies trapped per trap on 16/07/2017 was in the range of 0.00 to 7.00. The results revealed that the maximum (7.00) number of fruit flies were trapped in the treatment T<sub>2</sub> (Black *Ocimum* + Malathion) which was found to be significantly superior over the rest of the treatments except treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) and T<sub>1</sub> (Green *Ocimum* + Malathion) which recorded 6.00 and 5.33 mean number of fruit flies respectively, and both the treatments were at par with the treatment T<sub>2</sub>. The next best treatments in order of efficacy were T<sub>7</sub> (Green *Ocimum* + Spinosad), T<sub>3</sub> (Black Jaggery + Malathion), T<sub>6</sub> (Molasses + Malathion), T<sub>9</sub> (Black Jaggery + Spinosad), T<sub>5</sub> (Cinnamon + Malathion) and T<sub>12</sub> (Molasses + Spinosad) which recorded 3.33, 2.67, 2.00, 2.00, 1.33 and 1.33 mean number of fruit flies respectively.

The observations recorded on the mean number of fruit flies trapped per trap on 21/07/2017 was in the range of 0.00 to 1.67. The data revealed that the maximum (1.67) number of fruit flies were trapped in the treatment T<sub>2</sub> (Black *Ocimum* + Malathion) and was significantly superior over the rest of the treatments except treatment T<sub>8</sub> (Black *Ocimum* + Spinosad), T<sub>1</sub> (Green *Ocimum* + Malathion), T<sub>3</sub> (Black Jaggery + Malathion), T<sub>5</sub> (Cinnamon + Malathion), T<sub>6</sub> (Molasses + Malathion), T<sub>7</sub> (Green *Ocimum* + Spinosad), T<sub>9</sub> (Black Jaggery + Spinosad) which recorded 1.00, 1.00, 0.67, 0.67, 0.67, 0.67 and 0.67 mean number of fruit flies respectively, and all these treatments were at par with the treatment T<sub>2</sub>. The next best treatments in order of efficacy were T<sub>4</sub> (Common Jaggery + Malathion), T<sub>11</sub> (Cinnamon + Spinosad) and T<sub>12</sub>

(Molasses + Spinosad) which recorded 0.33, 0.33 and 0.33 mean number of fruit flies respectively.

The data on the total number of fruit flies trapped per trap during July 2017 was in the range of 0.00 to 33.67. The maximum (33.67) number of fruit flies were trapped in the treatment T<sub>2</sub> (Black *Ocimum* + Malathion) and was found to be significantly superior over rest of the treatments except treatment T<sub>8</sub> (Black *Ocimum* + Spinosad) which recorded 27.00 number of fruit flies per trap and both the treatments were at par with each other. The next best treatments in order of efficacy were T<sub>1</sub> (Green *Ocimum* + Malathion) and T<sub>7</sub> (Green *Ocimum* + Spinosad) which recorded 22.67 and 17.00 number of fruit flies respectively and were at par with each other.

Earlier many workers worked on the effect of bait material in attracting Tephritids. Roomi *et al.* (1993) [8] reported that natural attractant of plant origin *i.e.*, from Tulsi (*Ocimum sanctum* L.) was isolated and extracted with view to applying for the control of fruit flies. A cotton pad treated with 0.25 ml leaf extract in ethyl acetate is found to be a potent attractant for luring and trapping the fruit flies (*Dacus* spp.) from a distance of 0.8 km. The effectiveness of *Ocimum* was reported earlier by Jiji *et al.* (2003) [7], Thomas *et al.* (2005) [10] and Singh (2008) [9]. Thomas *et al.* (2005) [10] found that a 50:50 mix of banana and jaggery caught more flies than banana alone, jaggery alone and trap containing *Ocimum* and protein hydrolysate and indicated a positive interaction in mixing of banana with jaggery as bait. Jhala *et al.* (2005) [6] concluded that, overall, banana and jaggery, at 10 per cent (mass: volume) in water and in isolation or combination (and with added fresh fruit when this is seasonally available and inexpensive), are generally cost-effective baits for Tephritid management in India. Akhtaruzzaman *et al.* (2000) [4] reported that application of molasses + Malathion + water in the ratio of 1:0.1:100 provided good control of *B. cucurbitae* in Japan. Dharmadasa *et al.* (2015) [5] described the morphology, essential oil content, composition and bioassay on ability of essential oil of two *Ocimum tenuiflorum* morphotypes as fruit fly attractant. The main constituents found in the oil of MT<sub>1</sub> were methyl eugenol. They reported that the essential oil of *Ocimum tenuiflorum* can be used as potential natural Para pheromone source for fruit fly control and monitoring in fruit industry in Sri Lanka.

**Table 1:** Fruit fly population trapped with different attractants during May 2017.

Treatment No.	Treatment Detail	Mean fruit fly trapped/trap/5 days			Total
		17/5/2017	22/5/2017	27/5/2017	
T <sub>1</sub>	Green <i>Ocimum</i> + Malathion	36.33 (6.10)*	33.33 (5.85)	32.67 (5.80)	102.33 (10.16)
T <sub>2</sub>	Black <i>Ocimum</i> + Malathion	45.33 (6.80)	47.67 (6.97)	47.00 (6.92)	140.00 (11.87)
T <sub>3</sub>	Black Jaggery + Malathion	27.00 (5.28)	31.00 (5.64)	30.67 (5.61)	88.67 (9.46)
T <sub>4</sub>	Common Jaggery + Malathion	12.33 (3.64)	16.67 (4.18)	16.00 (4.11)	45.00 (6.76)
T <sub>5</sub>	Cinnamon + Malathion	21.00(4.62)	28.00 (5.37)	27.33 (5.31)	76.33 (8.77)
T <sub>6</sub>	Molasses +Malathion	25.00 (5.10)	31.00 (5.64)	29.67 (5.51)	85.67 (9.29)
T <sub>7</sub>	Green <i>Ocimum</i> + Spinosad	33.00 (5.83)	27.67 (5.34)	27.00 (5.28)	87.67 (9.41)
T <sub>8</sub>	Black <i>Ocimum</i> + Spinosad	42.67 (6.61)	41.67 (6.52)	41.00 (6.48)	125.33 (11.23)
T <sub>9</sub>	Black Jaggery + Spinosad	32.67 (5.79)	23.67 (4.90)	23.00 (4.84)	79.33 (8.94)
T <sub>10</sub>	Common Jaggery + Spinosad	15.33 (4.00)	14.67 (3.92)	14.67 (3.92)	44.67 (6.69)
T <sub>11</sub>	Cinnamon + Spinosad	20.67 (4.63)	21.00 (4.62)	20.33 (4.61)	62.00 (7.89)
T <sub>12</sub>	Molasses + Spinosad	22.00 (4.78)	22.67 (4.81)	22.00 (4.78)	66.67 (8.21)
T <sub>13</sub>	Control (Trap without attractant)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)
	S.E.	0.23	0.34	0.32	0.40
	C.D. at 5%	0.67	0.99	0.95	1.16

\*Figures in parentheses are  $\sqrt{n+1}$  transformed values.

**Table 2:** Fruit fly population trapped with different attractants during June 2017.

Treatment No.	Treatment Detail	Mean fruit fly trapped/trap/5 days						Total
		1/6/2017	6/6/2017	11/6/2017	16/6/2017	21/6/2017	26/6/2017	
T <sub>1</sub>	Green <i>Ocimum</i> + Malathion	30.67(5.62) *	28.00(5.36)	18.67(4.43)	26.00(5.18)	19.33(4.51)	11.00(3.46)	133.67(11.60)
T <sub>2</sub>	Black <i>Ocimum</i> + Malathion	45.67(6.82)	40.33(6.43)	23.67(4.90)	35.00(5.99)	28.33(5.41)	17.00(4.24)	190.00(13.81)
T <sub>3</sub>	Black Jaggery + Malathion	29.33(5.49)	23.00(4.84)	13.33(3.74)	17.00(4.24)	14.67(3.92)	10.33(3.36)	107.67(10.41)
T <sub>4</sub>	Common Jaggery + Malathion	15.00(3.99)	12.00(3.58)	7.00(2.77)	9.33(3.21)	5.33(2.47)	2.67(1.87)	51.33(7.20)
T <sub>5</sub>	Cinnamon + Malathion	26.00(5.19)	22.00(4.78)	12.33(3.61)	15.33(3.96)	9.33(3.21)	3.67(2.05)	88.67(9.45)
T <sub>6</sub>	Molasses + Malathion	27.67(5.34)	22.67(4.79)	13.33(3.74)	15.33(3.96)	12.00(3.58)	6.67(2.72)	97.67(9.93)
T <sub>7</sub>	Green <i>Ocimum</i> + Spinosad	25.33(5.12)	24.33(5.01)	17.00(4.24)	25.33(5.12)	17.00(4.24)	9.00(3.15)	118.00(10.90)
T <sub>8</sub>	Black <i>Ocimum</i> + Spinosad	39.33(6.35)	39.00(6.32)	22.33(4.81)	33.67(5.87)	26.67(5.26)	12.00(3.58)	173.00(13.18)
T <sub>9</sub>	Black Jaggery + Spinosad	22.00(4.78)	21.33(4.63)	12.33(3.61)	15.33(3.96)	11.33(3.48)	6.67(2.72)	89.00(9.44)
T <sub>10</sub>	Common Jaggery + Spinosad	12.33(3.61)	11.33(3.48)	6.00(2.53)	6.33(2.71)	5.00(2.43)	2.00(1.72)	43.00(6.60)
T <sub>11</sub>	Cinnamon + Spinosad	19.33(4.47)	20.33(4.61)	10.67(3.38)	14.67(3.92)	8.00(2.98)	3.67(2.05)	76.67(8.78)
T <sub>12</sub>	Molasses + Spinosad	21.00(4.69)	21.33(4.63)	12.33(3.61)	15.33(3.96)	10.33(3.36)	4.33(2.23)	84.67(9.25)
T <sub>13</sub>	Control (Trap without attractant)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)
	S.E.	0.32	0.24	0.27	0.34	0.18	0.27	0.26
	C.D. at 5%	0.94	0.69	0.78	1.00	0.54	0.79	0.78

\*Figures in parentheses are  $\sqrt{n+1}$  transformed values.

**Table 3:** Fruit fly population trapped with different attractants during July 2017.

Treatment No.	Treatment Detail	Mean fruit fly trapped/trap/5 days					Total
		1/7/2017	6/7/2017	11/7/2017	16/7/2017	21/7/2017	
T <sub>1</sub>	Green <i>Ocimum</i> + Malathion	8.33(3.02)*	3.33(2.06)	4.67(2.35)	5.33(2.49)	1.00(1.38)	22.67(4.81)
T <sub>2</sub>	Black <i>Ocimum</i> + Malathion	13.67(3.81)	5.33(2.49)	6.00(2.55)	7.00(2.76)	1.67(1.63)	33.67(5.85)
T <sub>3</sub>	Black Jaggery + Malathion	7.00(2.76)	2.33(1.82)	2.33(1.82)	2.67(1.91)	0.67(1.24)	15.00(3.99)
T <sub>4</sub>	Common Jaggery + Malathion	2.33(1.82)	1.33(1.52)	0.67(1.24)	1.00(1.38)	0.33(1.14)	5.67(2.51)
T <sub>5</sub>	Cinnamon + Malathion	4.00(2.19)	2.33(1.82)	1.33(1.52)	1.33(1.52)	0.67(1.24)	9.67(3.24)
T <sub>6</sub>	Molasses + Malathion	4.00(2.19)	2.33(1.82)	1.67(1.63)	2.00(1.72)	0.67(1.24)	10.67(3.40)
T <sub>7</sub>	Green <i>Ocimum</i> + Spinosad	6.33(2.65)	3.00(1.99)	3.67(2.14)	3.33(2.06)	0.67(1.24)	17.00(4.24)
T <sub>8</sub>	Black <i>Ocimum</i> + Spinosad	9.33(3.21)	5.00(2.43)	5.67(2.51)	6.00(2.55)	1.00(1.38)	27.00(5.27)
T <sub>9</sub>	Black Jaggery + Spinosad	5.67(2.51)	2.33(1.82)	2.00(1.72)	2.00(1.72)	0.67(1.24)	12.67(3.67)
T <sub>10</sub>	Common Jaggery + Spinosad	1.00(1.38)	0.67(1.24)	0.33(1.14)	0.33(1.14)	0.00(1.00)	2.33(1.82)
T <sub>11</sub>	Cinnamon + Spinosad	2.33(1.82)	2.00(1.72)	1.00(1.38)	0.67(1.24)	0.33(1.14)	6.33(2.65)
T <sub>12</sub>	Molasses + Spinosad	2.67(1.91)	2.00(1.72)	1.67(1.63)	1.33(1.52)	0.33(1.14)	8.00(2.99)
T <sub>13</sub>	Control (Trap without attractant)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)
	S.E.	0.24	0.18	0.20	0.20	0.14	0.25
	C.D. at 5%	0.71	0.54	0.60	0.60	0.43	0.75

\*Figures in parentheses are  $\sqrt{n+1}$  transformed values.

## Conclusion

From the present investigation it can be concluded that all the bait material used for attracting fruit flies were more or less effective but in the treatment T<sub>2</sub> (black *Ocimum* (leaf extract) + Malathion) and treatment T<sub>8</sub> (black *Ocimum* (leaf extract) + Spinosad) attracted maximum number of fruit flies as well as five different species of fruit flies. Black *Ocimum* (leaf extract) + Malathion or black *Ocimum* (leaf extract) + Spinosad can be used as baiting material for trapping fruit flies in mango orchard. The baiting material is easily available at farmer's field, cheaper and effective therefore can be replaced in absence of methyl eugenol. Similarly, the results envisages that the fruit fly traps can be installed in mango orchard up to July *i.e.* till left over mango fruits are available that can diapause as pupal stage in soil and that will reduce fruit fly population in next year.

## References

- Anonymous. NHB, Indian Horticulture Database published by National Horticulture Board, New Delhi, 2014, 95-96.
- Anonymous. Area, production and productivity of mango in India. Indian Horticulture Database, 2015a, 12-13.
- Anonymous. The fruit king is back, almost. Hindu business line, 2015b, 17-18.
- Akhtaruzzaman M, Alam MZ, Ali-Sardar MM. Efficiency of different bait sprays for suppressing fruit fly on cucumber. Bulletin of the Institute of Tropical Agriculture, Kyushu University. 2000; 23:15-26.
- Dharmadasa RM, Siriwardhane DAS, Samarasinghe K, Rangana SHCS, Nugaliyadda L. Indika Gunawardane et al. Screening of two *Ocimum tenuiflorum* L. (Lamiaceae) morphotypes for their morphological characters, essential oil composition and fruit fly attractant ability. World J. Agric. Res. 2015; 3(1):1-4.
- Jhala RC, Sisodiya DB, Sardana HR, Tyagi A, Patel ZP, Jagadale VS et al. Laboratory and field effectiveness of tephritid fruit fly baits in Gujarat and elsewhere in India. Pest Management in Horticulture Ecosystem. 2005; 11(2):91-98.
- Jiji T, Napoleon A, Stonehouse J, Verghese A. Efficient food baits for trapping fruit flies. Insect Environment. 2003; 9(3):143-144.
- Roomi MW, Abbas T, Shah AH, Robina S, Qureshi SA, Hussain SS, et al. Control of fruit flies (*Dacus* spp.) by attractants of plant origin. Anzeiger Fur Schadlingskunde Pflanzenschutz Umweltschutz. 1993; 66(8):155-157.
- Singh R. Studies on varietal susceptibility of oriental fruit fly, *Bactrocera dorsalis* (Hendel) on guava and its attraction to different poison baits. Asian J Bio Sci. 2008; 3(2):330-332.

10. Thomas J, Faleiro R, Vidya CV, Satarkar VR, Stonehouse JM, Verghese A, *et al.* Melon fly attraction and control by baits in central Kerala. Pest management in Horticulture Ecosystem. 2005; 11(2):110-112.